

Kal-Equip 2202 DIGITAL MULTIMETER INSTRUCTION MANUAL

SAFETY GUIDELINES

Your Digital Multimeter is designed for both home and automotive use. The following Safety Guidelines are provided when it is used for engine or vehicle testing. To prevent accidents that could result in serious injury and/or damage to your vehicle or test equipment, carefully follow these safety rules and test procedures.

SAFETY EQUIPMENT

Fire Extinguisher

Never work on your car without having a suitable fire extinguisher handy. A 5-lb or larger CO₂ or dry chemical unit specified for gasoline/chemical/electrical fires is recommended.

Fireproof Container

Rags and flammable liquids should be stored only in fireproof, closed metal containers. A gasoline-soaked rag should be allowed to dry thoroughly outdoors before being discarded.

Safety Goggles

We recommend wearing safety goggles when working on your car, to protect your eyes from battery acid, gasoline, and dust and dirt flying off moving engine parts. **NOTE:** Never look directly into the carburetor throat while the engine is cranking or running, as sudden backfire can cause burns.

LOOSE CLOTHING AND LONG HAIR (MOVING PARTS)

Be very careful not to get your hands, hair or clothes near any moving parts such as fan blades, belts and pulleys or throttle and transmission linkages. Never wear neckties or loose clothing when working on your car.

JEWELRY

Never wear wrist watches, rings or other jewelry when working on your car. You'll avoid the possibility of catching them on moving parts or causing an electrical short circuit which could shock or burn you.

VENTILATION

The carbon monoxide in exhaust gas is highly toxic. To avoid asphyxiation, always operate vehicle in a well-ventilated area. If vehicle is in an enclosed area, exhaust should be routed directly to the outside via leakproof exhaust hose.

SETTING THE BRAKE

Make sure that your car is in Park or Neutral, and that the parking brake is firmly set.

NOTE: Some vehicles have an automatic

release on the parking brake when the gear shift lever is removed from the PARK position. This feature must be disabled when it is necessary (for testing) to have the parking brake engaged when in the DRIVE position. Refer to your vehicle service manual for more information.

HOT SURFACES

Avoid contact with hot surfaces such as exhaust manifolds and pipes, mufflers (catalytic converters), radiator and hoses. Never remove the radiator cap while the engine is hot, as escaping coolant under pressure may seriously burn you.

SMOKING AND OPEN FLAMES

Never smoke while working on your car. Gasoline vapor is highly flammable, and the gas formed in a charging battery is explosive.

BATTERY

Do not lay tools or equipment on the battery. Accidentally grounding the "HOT" battery terminal can shock or burn you and damage wiring, the battery or your tools and testers. Be careful of contact with battery acid. It can burn holes in your clothing and burn your skin or eyes.

When operating any test instrument from an auxiliary battery, connect a jumper wire between the negative terminal of the auxiliary battery and ground on the vehicle under test. When working in a garage or other enclosed area, auxiliary battery should be located at least 18 inches above the floor to minimize the possibility of igniting gasoline vapors.

HIGH VOLTAGE

High voltage - 30,000 to 50,000 volts - is present in the ignition coil, distributor cap, ignition wires and spark plugs. When handling ignition wires while the engine is running, use insulated pliers to avoid a shock. While not lethal, a shock may cause you to jerk involuntarily and hurt yourself.

JACK

The jack supplied with the vehicle should be used only for changing wheels. Never crawl under car or run engine while vehicle is on a jack.

THREE (3) YEAR LIMITED WARRANTY

Kal-Equip, a division of Actron Manufacturing Company ("Kal-Equip"), warrants to the original purchaser that this product will be free from defects in materials and workmanship for a period of three (3) years from the date of original purchase. Any unit that fails within this period will be replaced or repaired at Kal-Equip's discretion without charge. If you need to return product, please follow the instructions below. This warranty does not apply to damages (intentional or accidental), alterations or improper or unreasonable use.

DISCLAIMER OF WARRANTY

KAL-EQUIP DISCLAIMS ALL EXPRESS WARRANTIES EXCEPT THOSE THAT APPEAR ABOVE. FURTHER, KAL-EQUIP DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OF THE GOODS OR FITNESS OF THE GOODS FOR ANY PURPOSE. (TO THE EXTENT ALLOWED BY LAW, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS APPLICABLE TO ANY PRODUCT IS SUBJECT TO ALL THE TERMS AND CONDITIONS OF THIS LIMITED WARRANTY. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THIS LIMITATION MAY NOT APPLY TO A SPECIFIC BUYER.)

LIMITATION OF REMEDIES

IN NO CASE SHALL KAL-EQUIP BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES BASED UPON ANY LEGAL THEORY INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOST PROFITS AND/OR INJURY TO PROPERTY. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THIS LIMITATION OR EXCLUSION MAY NOT APPLY TO A SPECIFIC BUYER. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

OUT OF WARRANTY REPAIR

If you need product repaired after your warranty has expired, please call Tech Support at (800) 253-9880. You will be advised of the cost of repair and any freight charges.

DESCRIPTION AND SPECIFICATIONS

DESCRIPTION: The Digital Multimeter is a compact, hand-held, easy to use precision instrument which is compatible both with home electrical applications, as well as the electrical systems used in modern passenger cars and trucks. It may also be used to measure voltages in the computer control circuits of computer-controlled vehicles.

SPECIFICATIONS:

Display - 3-1/2 digit LCD (Liquid Crystal Display)

Automatic Polarity Sensing - Display shows a minus (-) sign on the DCV (DC Volts) and DCmA (DC Milliamps) functions when lead hookup is reversed.

Zero adjustment - Unit automatically zeroes on the DCV, ACV and DCmA functions.

Overrange indication - Left side of display shows either "1." or "-1." when range in a function is exceeded.

Operating temperature - 5°C - 35°C (40°F - 95°F), 0-70% Relative Humidity; 35°C - 50°C (95°F - 122°F), 0-60% Relative Humidity.

Power - Nine (9) volt alkaline or carbon zinc battery (NEDA 1604)

Battery life - Alkaline: 200 hours typical
Carbon zinc: 100 hours typical

Battery indicator - Display indicates "LO BAT" when less than 10% of life remains

Accessories - Test leads (pair), alligator clips (pair), instruction manual

FUNCTIONS AND DISPLAY:

The multimeter provides the following functions and displays them as indicated.

OFF - To preserve battery life always return the rotary switch to OFF when testing is complete.

DATA HOLD - For convenience and safety when measuring in hard to reach circuits, this function holds the last stable measurement on the display for later viewing. Pressing the DATA HOLD button toggles the function on and off.

AC Volts

Range	Resolution	Accuracy (45Hz-450Hz)	Maximum Input
200V	100mV	± (1.0% rdg + 10 dgts)	750V
750V	1V	± (1.2% rdg + 10 dgts)	

Input Impedance: 450KΩ

DC Volts

Range	Resolution	Accuracy	Maximum Input
200mV	100μV	± (0.5% rdg + 5 dgts)	1000V
2V	1mV		
20V	10mV		
200V	100mV	± (0.75% rdg + 5 dgts)	
1000V	1V		

Input Impedance: 10MΩ

DC Current

Range	Resolution	Accuracy	Overload Protection
200μA	0.1μA	± (1.0% rdg + 5 dgts)	200mA/250V fuse
2mA	1μA		
20mA	10μA		
200mA	100μA	± (1.5% rdg + 5 dgts)	
10A	10mA		10A/250V fuse

Overload protection: 200mA/250V fuse and 10A/250V fuse

Resistance

Range	Resolution	Accuracy	Maximum Input
200Ω	0.1Ω	± (1.0% rdg + 5 dgts)	250V DC or RMS
2KΩ	1Ω		
20KΩ	10Ω		
200KΩ	100Ω		
2MΩ	1KΩ		
20MΩ	10KΩ	± (1.2% rdg + 5 dgts)	

Maximum open circuit voltage: 2.8V

Diode Check

Use this test to check for open or shorted diodes. A good diode will show a low reading with the test leads connected in one polarity, and a high reading with the test leads connected in the other polarity. The low reading will be typically some three-digit number on the display (for example: .673). The actual number is not critical. The high reading should be infinity (1.).

A shorted diode will have a low reading in both directions. An open diode will read "1." or "1." in both directions.

PRECAUTIONS AND PREPARATION FOR MEASUREMENT:

1. Be sure that a fresh nine (9) volt battery is correctly installed in the multimeter.
2. Compare the position of the selector switch with the anticipated test result. In the case of voltage or current measurement, always select a range which is high enough to handle the worst case result! Voltage or current may be higher than you expect.
3. The **BLACK** test lead is always inserted in the **COM** (Common) jack on the multimeter. The **RED** test lead must be inserted in either the **V/Ω** (Continuity/Diode Volts/Ohms) jack, **mA** (milliamps) jack, or the **10A** (10 Amps) jack depending on the test being performed. **Incorrect placement of the RED test lead may damage the multimeter, the circuit under test, or both!**
4. Operate the multimeter only in temperatures between 5°C and 50°C (40°F - 122°F), and at 70% or less relative humidity.
5. Turn the SELECTOR switch to the OFF position when testing is completed. If the multimeter will not be used for an extended period of time, remove the internal nine (9) volt battery to avoid damage from leakage.
6. Do not store the multimeter in direct sunlight, or in areas of high temperature or high humidity.

MEASUREMENT PROCEDURES:

1. VOLTAGE MEASUREMENT

- a. Set the SELECTOR switch to the required **ACV** or **DCV** position.
- b. Plug the **BLACK** test lead into the **COM** input jack on the multimeter.
- c. Plug the **RED** test lead into the **V/Ω** input jack on the multimeter.
- d. Connect the test leads to the circuit under test, observing proper polarity when measuring DC voltage.
- e. Read the result on the digital display. If the display reads overrange (1.), switch to a higher range within the appropriate AC or DC function.

2. DC CURRENT MEASUREMENT

- a. Set the SELECTOR switch to the required **DCmA** position.
- b. Plug the **BLACK** test lead into the **COM** input jack on the multimeter.
- c. Plug the **RED** test lead into the **mA** input jack on the multimeter.
- d. Connect the test leads to the circuit under test, observing proper polarity.
- e. Read the results on the digital display. If the display reads overrange (1.), switch to a higher range within the DC milliamps function.

3. 10A CURRENT MEASUREMENT

- a. Set the SELECTOR switch to the **10A** position.
- b. Plug the **BLACK** test lead into the **COM** input jack on the multimeter.
- c. Plug the **RED** test lead into the **10A** input jack on the multimeter.
- d. Connect the test leads to the circuit under test, observing proper polarity.
- e. Read the result on the digital display.

4. RESISTANCE MEASUREMENT

- a. Set the SELECTOR switch to the required resistance **Ω OHMS** position.
- b. Plug the **BLACK** test lead into the **COM** jack.
- c. Plug the **RED** test lead into the **V/Ω** input jack.
- d. Connect the test leads to the circuit under test.
- e. Read the result on the digital display. If the display reads overrange (1.), switch to a higher range within the resistance function.

5. DIODE CHECK

- a. Set the SELECTOR switch to the **Diode** position.
- b. Plug the **BLACK** test lead into the **COM** input jack.
- c. Plug the **RED** test lead into the **V/Ω** input jack.
- d. Connect the test leads to the diode under test. The diode must be removed from the circuit to achieve proper results.
- e. Read the result on the digital display.
- f. Reverse the test lead connections at the diode.
- g. Read the result on the digital display.
- h. A good diode will show a low reading with the test leads connected one way, and infinity (1.) with the test leads connected the other way. The low reading will typically be some three-digit number on the display. The actual number is not critical.

6. CONTINUITY CHECKS

- a. Plug the **RED** test lead into the **V/Ω** input jack.
- b. Plug the **BLACK** test lead into the **COM** input jack.
- c. Set the SELECTOR switch to the **200Ω / V/Ω** position.
- d. Connect the test lead to the circuit under test. Buzzer sounds if the resistance at the circuit is below 100 Ohms.

FUSE and BATTERY REPLACEMENT:

All current ranges of this multimeter are fuse protected. Should you exceed maximum current flow in any of these ranges, the fuse may open. To maintain safe operation of the multimeter, replace the 200mA fuse only with a 200mA, 250 Volt, 5mm x 20mm fast-acting glass fuse, and replace the 10A fuse only with a 10A, 250V, 1-1/4 inch fast-acting ceramic fuse. Replace the fuses as follows:

1. Turn the SELECTOR switch OFF.
2. Remove the bottom case half.
3. Remove the battery.
4. Using a small blade screwdriver or other suitable tool, gently pry the open fuse out of its holder.
5. Install a new fuse.
6. Re-install the battery, and bottom case half.

REPLACEMENT PARTS

The following replacement parts are available for your multimeter. Consult your retailer or the manufacturer for assistance.

PART NUMBER	DESCRIPTION
0002-000-2353	Instruction Manual
0044-000-0121	200mA 250 Volt Glass Fuse
0044-000-0118	10A 250 Volt Ceramic Fuse
0038-000-1975	Red/Black Test Lead Set
0038-000-0627	Red/Black Alligator Clip Set

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